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ABSTRACT

This collection of speeches, presented as the 1974 Marine Occupations Conference in South Portland, Maine, provides an overview of information regarding availability and kinds of careers in, as well as the educational requirements for, marine occupations. Also reviewed are the problems of developing marine resources, such as those involving location of new fisheries, pollution of established fishing areas, conflicts of harvesting by fishermen using different kinds of gear, economic problems in developing new industry, aquaculture, marketing of seafoods. The occupations of naval architecture, modern fishing gear design, and ocean engineering are described in detail. (CS)

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MARINE OCCUPATIONS

CONFERENCE

Friday, April 5, 1974
Southern Maine Vocational Technical Institute
South Portland, Maine

Edited by
Phyllis Coggins
Paul D. Ring
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MARINE OCCUPATIONS CONFERENCE

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South Portland, Maine

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DR. WARREN LITTLE

I am Director of Education at the New England Aquarium in Boston, and I would like to welcome you here on behalf of the Southern Maine Vocational Technical Institute, Cooperative Extension Service of the University of Maine and New England Aquarium to our Marine Occupations Conference today.

I have a story about our arrival from Boston. Our directions were to take the Broadway exit off the Maine Turnpike and to follow Broadway to the end, but, as is apt to be the case, there was one point when we were not quite sure which way Broadway went, and we took the wrong turn. So it seemed prudent, rather than rolling through the back woods of South Portland and perhaps Portland itself, to stop and ask directions. We spotted a typical Maine gentleman on his front porch in his rocking chair, pulled over and asked, "Can you tell us how to get back onto Broadway?" Well, he sat there, kind of puffing on his pipe and then he got up from his rocking chair, turned it from the direction he had been rocking in and then sat down and began rocking again. I wasn't sure if he had heard me or not, so I asked again if he could tell me where Broadway was and where we headed for SMVTI. He puffed on his pipe, got up and turned his rocking chair back around to right angles; then he answered the question, and it was quite obvious that we had taken the wrong turn. Well, of course, by that time my curiosity had gotten the better of me, so I asked him why he had taken his rocking chair and turned it at right angles, rocked some and then turned it back and rocked some more. He looked at me and said, "Well, I'll tell you. I'm having a hard time making up my mind whether I want to rock east and west with the breeze this morning or north and south with the grain of wood!" It occurred to me that this is the same type of decision that confronts us in terms of occupations and directions we should be going in--both as students and adults. I don't think any of us know whether we're going to follow the grain of the wood or the breeze when we start out in life. Some of us find at a late date that perhaps we should have taken the other direction. I think that's why it is important that we keep abreast of the routes there are to take in these areas, hence, our conference today.

I want to briefly give you some past history of these conferences. New England Aquarium has had a Marine Careers Conference every year since 1968 (this was the year before the Aquarium opened), so it has been an important part of the educational program. The Aquarium has always been interested in education and has the largest educational department of any aquarium in the country.

I joined the Aquarium in the spring of 1972, and at that time I began observing the program we were running in connection with Boston University and the Sea Rovers. We were primarily working with science teachers and students in the greater Boston area who would come to the Aquarium's Occupations Conference on Friday and then join the Sea Rovers Conference the following day. In evaluating the conferences it appeared that we were getting fewer and fewer teachers and that student attendance was also dropping off. My feeling was that we should move to single-day conferences and aim the conference primarily at those people who are involved in the area of counseling. I also thought that we should expand conference participation.

Last year we launched a program that varied from previous conferences. We ran it in connection with Boston University, but we offered it for guidance counselors in the State of Massachusetts and were overwhelmed with applications for it. We had a very successful conference with about seventy guidance counselors last year.

I have been anxious to get the conferences into other New England states, so I was extremely pleased when John Greer and Tapan Banerjee of SMVTI were willing to provide a location for us, and Paul Ring and the Extension Service were willing to help us with getting publicity out about today's conference. We hope to follow this up next year and hold the conference in Rhode Island. We then hope to go into New Hampshire and Vermont where we might change the marine career aspect to aquatic subjects. I am sure there are many there that we should look into in terms of new and potential jobs and education for students who are just getting out of school.

I would now like to introduce our host for today, Dr. John Greer, who is Director of SMVTI. Dr. Greer was a professor in industrial education at the University of Maine/Gorham before he came here. I am very pleased to

have Dr. Greer on the Aquarium's Education Advisory Committee representing Maine. It is a great pleasure to introduce him to you, and I thank him for having us.

DR. JOHN GREER

Good morning and welcome to SMVTI. Usually at this point I launch into my hour-long discussion extolling the virtues of SMVTI, but I will spare you that this morning because we have so many of our staff members here. I am sure that if you do have any questions and want any information that they can assist you much better than I can.

There is a full program for today. We have some top level people on the panel and several interesting topics to discuss. We at SMVTI are concerned with occupational education; therefore, it is very appropriate that a conference of this nature is being held here. We find that there are some patterns changing as far as young people are concerned with post-secondary education. One example that stands out right now is that about eleven percent of the applications for our incoming class are from people who already have either a B. S. or master's degree in another field and now want to come into some area of occupational education. This is perhaps an unheard-of occurrence, but I think it is indicative of some of the trends we have seen lately. I am sure that after you have listened to the speakers, who will provide you with some excellent information, that you will have ample opportunity to exchange your viewpoints on these particular subjects.

Again, welcome to SMVTI, and I hope that you have a very profitable day.

DR. WARREN LITTLE

Thank you very much, John. I would like to introduce our first speaker who will give us an overview in the area of opportunities in marine occupations. He is well qualified having an extensive background in oceanographic program administration and marine biology. He is currently the program manager of the Marine Advisory Services of the National Sea Grant Office, National Oceanic and Atmospheric Administration known as NOAA. I would like to introduce at this time, Mr. Howard Eckles.

HOWARD ECKLES

It was a very pleasant surprise for me to have this opportunity to come and speak with you this morning. I say that because I hope that after I have made some introductory remarks and provided some useful information that we will have a dialogue. It will be helpful for me to learn what is actually taking place in your individual schools and jobs.

I guess that on the average I get four to five letters a week in my office from students all over the country, stating, "I want to consider a career in oceanography. Will you please send me all the information you have that will help me find out more about this field?" I am immediately frustrated because the field is so wide; there is so much involvement that I hardly know what to say.

Exactly what is an oceanographer? I think the easiest thing to say is that he is a person who applies his particular interest to the sea. It can be an engineering interest, a scientific interest (biological, physical, geological, chemical). It is not really as tight and as specific as many of us have thought.

We should consider where the marine jobs are and who the employers are. The fishing industry is, and will continue to be, one of our most important marine industries. There will be an expansion of aquaculture. Ocean ranching is becoming a new marine field.

I have watched Paul Ring over the last two years with Maine's two boating associations in sponsoring workshops on Maine's fresh and salt water pleasure boat service industry. Recreational boating will continue to be popular and with this popularity it creates manpower demands for engineers, marine architects, mechanics and the supporting industries. I think if I were starting a new career, I would look in this area as a way to make a living. Shipping and the merchant marine are areas of continuing importance.

Another area of growth is the exploration and development of offshore resources, particularly oil and gas but other resources are becoming important. There is a substantial amount of sand and gravel production along the coast. A few companies are exploring for manganese nodules which are valuable for their copper and nickel content. Through contacts with the

Offshore Technology Group, the Marine Technology Society and others, we learned that this industry is at present having a reasonably difficult time getting enough of the right kinds of workers. There is a school in Texas that trains offshore workers and people in underwater diving. The statistics we get are that they have almost 100 percent placement of their graduates. It is very difficult work and often means long periods of time away from home. They work overseas as well as off the U. S. coast. There is a very high manpower demand in the area, and it is also very well paying.

Coastal engineering is important to our use of the oceans. It involves harbor and channel maintenance, protection from erosion forces, zoning, construction and many other things. There is a very wide array of work here including all aspects of surveying in determining of coastal zones, boundaries, high and low tide levels, determination of the high seas for jurisdictional purposes. Every state along the coast has some kind of problem in determining their boundaries relative to the land and water interface. It is basically civil engineering, and it can be very rewarding work. Lots of it is outdoors doing field measurements and so forth. People who train and work in coastal engineering have a highly marketable capability. If you are a trained engineer in mechanical engineering or civil engineering, either at the tradesman level or the professional level, there is ample opportunity for employment.

The area of education (teaching) will continue to be important. The interest on the part of young people and others in the natural history and the lore of the oceans has a real value to us. This interest has its economic aspects, but it certainly has its social and aesthetic values which I think transcend the economic aspects. It is important to have enough people working as teachers at the secondary level and beyond to inform students and create an interest in the ocean.

Extension and advisory work will have an increasing manpower demand in the future. Right now we have approximately one hundred and twenty people working full time throughout the Sea Grant system. In order to satisfy the requirements of a good solid program in each state, we are going to have to employ between three and four hundred people within a five-year span. Now this is not a great number of individuals, but it is difficult to recruit people with the interests, talents and abilities that we need.

Coastal Zone Management is a program that develops plans for the proper use of our coastline, and it creates an important manpower requirement. It means work in the economic, social and legal fields. States are going to be developing their plans. They will come to the federal government for approval, and this means funding will become available. After the state plan has been developed, there is a program which follows in order to initiate it, manage it, and this requires personnel at local, state and federal levels.

The area that I am sure is close to many of you is engine repair and maintenance. On the West Coast in the tuna fishing industry they use large, far-ranging ships, and their biggest manpower problem is finding people who can operate and maintain diesel engines. The trend in high quality tradesman work is very real. This is true in many areas of the fishing industry. If we want to turn this around a bit and look at some of the disciplines involved again, it is engineering, it is electronics and electrical engineering combined.

The Environmental Protection Act requires any major development (the installation of oil refineries, power generating plants, major construction changes in harbors, etc.) to produce a study of how this development will affect the environment. Companies have been formed for the sole purpose of making these environmental impact studies. The staff for one of these companies might include physical oceanographers, technicians, biologists and others to research and write the impact statements.

At the federal level we have some very interesting areas. The military has exciting things to do, and they need technical people. They do a lot of their own training, of course. There is the Coast Guard, there's NOAA Corps--there are a certain number of jobs available in this area. The Sea Grant people--the numbers change rapidly--work mostly through colleges and universities.

Research is also a marine employer--from the technical journeyman level on up the ladder to the highly specialized areas. The area of research extends from private industry to the universities.

One comment I would like to close with is about this aspect of "are there going to be jobs in marine affairs and marine trade and in the broad field of oceanography?" My answer is certainly yes. If our people have a

real interest in the area, it's one that really makes sense for them to follow up.

From an employment point of view, it is important for them to do enough exploration and find out what they really want, experiment and make sure they will like it. It is important to have some good training and be able to offer something. When this happens, of course the job opportunities really open up.

These are my overview remarks, and I hope we have gotten a good start.

Q. You didn't seem to mention anything about ocean law. Do you find that area opening up?

A. Yes. The fact that I didn't use that precise term was an oversight. The area is concerned with coastal zone management and with the international realm where there is an entire area of law and policy being developed. The management of common property resources, like fisheries, has many legal requirements, as does jurisdiction over coastal waters. There are very specialized requirements for people in this field.

Q. It was just announced that Georges Bank will be the prime area for offshore oil development on the East Coast. Will Russian rigs come in and park offshore?

A. There is a legal regime already set up here. The seabed minerals are now under international law and under the jurisdiction of the coastal state.

DR. WARREN LITTLE

We are now going to start the first of two workshops that we will have prior to lunch. As you can see from the program, we are starting with the secondary school level, secondary education preparation level, and then we will move into post secondary. After lunch we will move into the professional and graduate areas.

I am now going to turn the meeting over to Mary Cerullo who is our Coordinator of Curriculum Services at the Aquarium. Mary's emphasis is working with the teachers and showing them how they can better use the Aquarium.

MARY CERULLO

My role as moderator is to introduce Dr. Thayer Shafer. He is well prepared in the area of secondary education as he is the Marine Education Specialist for the NOAA Marine Advisory Service at the University of Rhode Island and, therefore, with the New England Marine Resources Information Program. Throughout New England questions about marine education are referred to him. He has done research on marine careers so he's well equipped to answer any questions and to give a thorough background, both from personal knowledge and from talking with teachers at the secondary education level.

DR. THAYER SHAFER

The main question asked me is, "What is meant by marine careers?" Traditionally, we thought of the Navy, Coast Guard, merchant marine and commercial fishermen. Now we think also in terms of the scientist, oceanographer or marine biologist.

The reason that our country became great early in its history was because it exploited the sea for economic reasons. After Columbus' discovery of America, fishing boats from many countries reaped the harvest at Georges Bank. After our land became settled, it was the cash flow brought in by the Yankee merchant captains which actually financed the beginning of this country.

So we must think about the commercial utilization of the sea. The real explosion in marine careers is going to come when we reap great economic benefits from the sea.

There is no science of oceanography. In fact, oceanography is the application of all man's knowledge towards the study of the ocean. An oceanographer may have almost any kind of background. For years oceanography went along quietly on its own, but Lloyd Bridges, Flipper and Jacques Cousteau have helped to popularize oceanography. Today one of the big things we are feeling in the education business is the Cousteau Effect.

First we should look at the education requirements for an oceanographer. At the high school level a student who wants to become an oceanographer

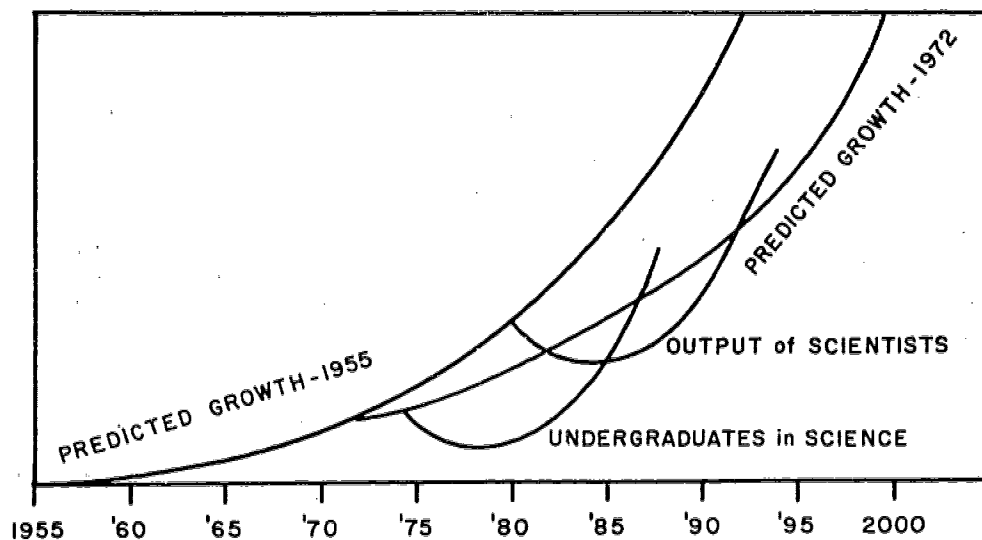
should take all the math and all the science he can get, and then everything else besides. The same thing can be said when you get to the college level. Regardless of specific interest--biology, physics, chemistry, geology--the student should take all the courses in his specific interest, math up through second or third year calculus, get a good working knowledge of statistics and then take all the basic courses in the other sciences. Generally speaking, upon graduation he can then get a job as an oceanographic technician, aide or something of that sort at Woods Hole or some other academic institution.

If the student is going on to the graduate level, he will have to figure on spending two or three years to get a master's degree and another three or four years beyond that to get his doctorate. He could become a certified surgeon in that period of time and go out and make \$50 thousand the first year, but there just seems to be no way around it. People in the academic world expect the person who is getting his degree in oceanography to be a Renaissance man. He's got to know everything about oceanography. One of the reasons that oceanographic technicians who come out of two-year vocational schools aren't hired by academic institutions like the University of Rhode Island is that there are a hundred people working on their master's degrees and other people working on their Ph.D's all looking for jobs. The whole ship is manned by people with master's degrees, so why should we go out and hire someone with only a 2-year program as an oceanographic technician? Now, this isn't the case in industry, but it is the case in the academic world in general.

I am not trying to discourage the students who really want to major in oceanography, but I feel we should cut through the aura of glory and glamour that has been created around oceanography. It's like the jobs available for divers. A lot of people want to be divers as a result of Cousteau's influence, but there are very few divers who are gainfully employed to swim around taking pictures of coral reefs. Most are working in water that is so murky they can't see their hands a foot away from their faces. They are doing things like cleaning the muck out of the intake grates for the power generating plant on the Providence River. They can't see what they are doing, the water is at the freezing point, and it's just plain miserable work. However, they jobs pay marvelously. There is a certain base rate

the minute a diver gets his toe wet. Now, if he can get away with that "dip a day", he can get enough to live very well. The glamorous jobs are few and far between. Diving is just like any other job. It's putting in your hours every day getting the things done that can be done.

Before I put the science and technology aspects of oceanography completely aside, I will refer to some studies that were done in the 1950's and 1960's with regard to manpower needs. Recently we have had an overkill. We had more people coming out with degrees than there were jobs. Last year I read all the manpower predictions, surveys and analyses of what had happened, and probably what is going to happen, and I put them together on a graph.



The first of these reports was done by Dr. Redfield who, at the time, was either director or retired director of the Woods Hole Oceanographic Institution. The Redfield report predicted that we would need a certain level of growth in order to satisfy our national needs and objectives and that oceanography should grow along the uppermost line of the chart. There was a substantial lack of people who had background or training related to this field, so the need for education programs was great. Schools like the University of Washington, the University of Rhode Island and many other institutions started gearing up their oceanography programs; then, some very interesting things happened. We were producing graduate students, and we still are getting graduates along this predicted growth rate; however, as you may recall, in the late 1960's and the early 1970's, we experienced

a social revolution where people and the nation reordered their priorities. This reordering was partially due to the unpopularity of the Viet Nam War and partially due to more concern about our social needs. We found that the number of undergraduates going into science in general had dropped off. I don't know if the trend has reversed itself yet, but this is going to affect the production of the graduate schools eight years hence. So, on that basis we can predict that there might be a drop-off in the production of graduate students in science and technology starting in the latter part of the 1970's and continuing to follow the same curve. If that does occur, and oceanography and the other areas of science and technology continue to grow along the present rate, we will find that in the mid 1980's we'll have a deficit again. Unfortunately, the surplus here cannot be applied against this predicted deficit because these people have to go out and get other jobs--paint houses or something like that. If you are an oceanographer and go and drive a taxi cab for five years, you can't jump back into oceanography because you're no longer at the state of the art.

The point of this graph is that students shouldn't say, "Oh, there aren't any jobs for oceanographers today, I don't want to become an oceanographer." Or, "There aren't any jobs for this today, I don't want to become this." The important thing is not to worry about the job market; do the thing you want to do, and if you are good, if you have confidence, you can sell that confidence to somebody. Maybe not in exactly the area you originally started out in, but in some area that is of interest.

Approximately 97.2 percent of the world's waters are ocean, and seventy percent of the world's population lives within about thirty miles of the water. So, when we start talking about land-use management problems, most of them exist in a very, very narrow band right along the edge of the water where most of us live. There is a marine corollary for almost every job there is on land.

Today we need outboard repair men, sail makers, engineers to design and laborers to build all sorts of things. I'm not just talking about docks and bridges; we have a lot of energy needs right now. We've talked about oil wells offshore, but those of you who are keeping up with the news will know that the big thing is using thermal differences--using the difference between the temperature of the ocean surface and the temperature of the water a couple of hundred feet down to run very low pressure turbines to

generate electricity. These turbines float at mid-depths in the ocean and the excess heat creates an upwelling of nutrient-rich waters, thereby producing feeding grounds for a new fishery. Then there is the problem of getting this electricity ashore. The way to do this is to use the electricity to electrolyze the water and produce hydrogen and oxygen. The hydrogen is pumped through gas mains that exist all over this country. (A conference was held recently in Miami on the hydrogen economy.) We can then convert all of our internal combustion engines to hydrogen. What happens when you burn hydrogen? The waste product is water, one of the primary commodities we need.

What I am trying to say is that if you are interested and if you have imagination and drive, you can create a job or find a job with almost any background if you are willing to work, if you can produce, and if you are willing to risk a little bit.

For every job on the sea, there are probably several dozen jobs on the edge of the sea to back it up. We have got to think about ship's chandlers, shipping agents, import and export merchants, people in the petroleum industry. (Right now in Todd's Ship Yards in Houston, Texas, there is a big demand for welders. It's not working on a ship, but it certainly is a living related to the sea. And if you can learn to weld under water, you can get a salary that makes the rest of us look like poor men.)

Mention was made of diesel engineers. There is a great need for diesel engineers not just to maintain the engines in the marine trade and the tankers but also to service the small diesel engines that are used as auxiliary engines in the marine recreation business. There are at least twenty-five makers of small diesel engines, and very few people know anything about servicing them. If you have one guy who is a good diesel mechanic and trouble shooter, he can get a job almost any place in the recreation industry.

The point that I have been trying to make in regard to preparation at the secondary level for marine careers is that whatever it is an individual enjoys doing and wants to do, if he learns to do it well, he can apply it in the marine environment if he wants to do so. And if there isn't a job out there waiting for him, he can make a job. It takes imagination, drive, fortitude, guts and a willingness to risk a little something if you are going to look for a job that doesn't offer the security of a conventional job.

Q. If a student is interested in oceanography, he does not get a degree in oceanography. Can you explain?

A. Probably ninety percent of the people who work in oceanography have earned their degrees in some other field. They have taken their expertise in their field and applied it to a marine environment. A degree in any form of oceanography per se is a relatively new thing. Generally speaking, if you have a degree in oceanography, you have a very broad background and then you specialize in some area such as geological oceanography, biological oceanography, chemical oceanography or physical oceanography. What you do under that title can be almost anything.

Q. Getting back to the secondary level, is it possible that we could have diesel mechanic training as we have auto mechanic training in vocational high schools?

A. I don't know of any reason why not. Several schools have done this. The most successful one that I know of is in Ilwaco, Washington.

Q. Are girls entering the marine science programs?

A. Oh, yes. During the time that I was a graduate student at the University of Rhode Island, the graduate student with the most sea time was a girl who was working on her doctorate in geological oceanography. At that time 25 to 30 of 150 graduate students were girls.

Q. I would like the guidance counselors to tell us what their most difficult problem is in advising students about marine careers.

A. I think it is lack of knowledge about marine careers.

A. There are few definitions of jobs in marine careers. The Department of Labor, for instance, has hundreds of job categories but does not define an oceanographic technician or marine technician. A company will tell you they have no jobs for marine technicians, but they will have twenty men running their ship every day; however, they hired them as electronic technicians or engineering technicians or something else--not as oceanographic technicians.

A. Most of the materials I have received have been for the master's or doctoral level of oceanography education. What we need is information about two-year vocational or community college programs.

DR. WARREN LITTLE

My experience has suggested that we do kids a great disservice if we make them into hotshot biologists in one specific field at the high school level. My personal feeling is we should be opening up doors. They may not go through those doors for many years to come, but we can give them a general background and get them started--and also make them understand that not everyone needs a doctorate to get a good job in the marine field.

We will be moving along now to the post-secondary level. Tapan is going to take charge of this program, so I will now turn it over to him.

DR. TAPAN BANERJEE

You have just heard about education and career opportunities in the secondary field. This session is going to deal with careers requiring post secondary education. In other words, we'll be talking about where to go if you want to study after the high school level but don't want to go to graduate school; you don't want to get a bachelor's degree but want to get some kind of training, some kind of occupational experience that will enable you to make a living in the marine field. I have two distinguished panel members with me. The first is Rad Romeyn, director of Project SEAL in Marion, Massachusetts, on Buzzards Bay. The program is one of the first of its kind in the nation. It is a year round marine apprentice type curriculum where high school graduates and seniors can enroll and find some skills or interests without making a two-year commitment.

RAD ROMEYN

I am not going to promote our program in Marion, but I am going to address a few of the directions in which we are moving.

Many of you are probably quite stimulated by oceanography and the potential of oceanography from listening to the information given today. I am wondering what is going to happen when you leave here today. How are you going to present all this information to best serve the students? Flashy cards don't seem to be the answer. I would like to suggest that

there have to be screening procedures in our guidance to high school students so they can have some criteria for making decisions that may lead them into the marine careers area, or anywhere else.

Most of our students are high school graduates of last year who have come to Project SEAL to get involved in introductory apprenticeships in order to gain experience and understanding so they can have some basis for making the decision of whether they want to become a commercial fisherman, oceanographer, boat builder, sail maker or whatever. I don't think the schools are equipping them very well at the secondary level with the ability to make these kinds of decisions, so I would like to introduce our ideas to you.

First, the students must have the information of what's available--an introduction to marine careers and marine sciences--so they can make preliminary decisions about whether they want to learn more about it. Then, if they do, we must interject into their curricula a sense of project responsibility--the taking on of an assignment and completing it because much of what we do in all of the marine careers is essentially that. They must not jump from one thing to another but must finish each project.

Another very important element in the decision-making process is obtaining experience on the job, whether it is in summer programs or incorporated in the year-long curriculum. It involves getting out and speaking with the people, with the commercial fisherman, the boat builder, marine architect, the professionals and the non-professionals. A student should ask them not only about the philosophy of what they are doing but also about the reality of the day-to-day schedule.

At Project SEAL we are committed to the belief that a terrific amount can be gained from learning through introductory apprenticeships or internships. There are certain stages of decision-making, and there has got to be a break between high school and college where field experience can be gained. We've developed procedures and models of programs whereby any school that is within twenty miles of the coast of Maine can develop a curriculum that involves giving the students experience in the field. We're a pilot program, and we would be very happy to share these models with you to make it easier and to show you different ways to get the community to share what they know with the students who are seeking information.

It's the responsibility of guidance counselors and teachers of science, or of any curriculum, to equip students with criteria for decision-making. I also want to emphasize what Thayer said about the need for students to understand that they've got to develop some unique, marketable skill, especially if they are going into marine careers. There is a need for skilled people, and the high school seniors of the last few years seem to be looking for something that is going to make them different. So, let's point them in the right direction and help develop people with marketable skills.

DR. TAPAN BANERJEE

Thank you very much. Now I would like to introduce Mr. Robert Goode of SMVTI.

ROBERT GOODE

SMVTI has been training students for marine occupations since the late 1950's. The present programs are given under the Department of Marine Science. There are two major programs. The first is Marine Science, a two-year program which offers both an Associate Degree and a diploma. This program follows a strict curriculum for the first two semesters which includes basic survey courses in oceanography, marine biology, navigation and seamanship, engineering and practical sea training. Some of the training occurs aboard our training vessel, Aqualab. As part of the training, biological samplings, temperature profiles, deep sediment samplings, etc., are performed, recorded and identified by the students. During the third and fourth semesters the students select advanced courses in the areas of their interest. If they choose, they may take courses approved by the Coast Guard and receive merchant marine licenses as officers on uninspected vessels such as towboats, tugboats, research vessels and others.

The second program is Applied Marine Biology and Oceanography. This program offers only an Associate Degree. Curriculum is aimed towards laboratory or coastal resource technicians; however, limited sea training and navigation are included.

Employment areas in which our graduates have been placed have been varied and are shifting as we see a fluctuation in the job market and in student interest. Fortunately, the broad scope of our program helps the students fill the jobs as they become available. Some examples of placement are: boat operators, crew members on survey or research ships, deck or engineering personnel, sometimes combined with oceanographic or biological technicians. Others are placed as diesel mechanics or operators, marine and oceanographic technicians, fishery technicians. A recent survey conducted by the Marine Science Department has indicated some potential areas that we may expand into--marine mechanics, hull maintenance, vessel repair. We are continually expanding our information on the industry, trying to ascertain the job market and keep our students up to date on current happenings.

Q. One of the serious problems for guidance counselors from out of state is in placing students in marine programs or in volunteer job experiences as a learning process. How can this be done?

A. Placing them in job experiences involves a lot of hustle on the part of the sponsor, especially if the student has just an interest and not a specific skill. A network of sources must be developed of people who are willing to hire students or take them as volunteers. I can help in the Buzzards Bay area. We can help with reinforcement models also. As far as getting students into SEAL, just apply. Write Project SEAL, Marion, Massachusetts.

Q. Does a student attend SEAL at his own expense?

A. Yes. It is a tuition-based program with a terrific amount of scholarship background; however, we take about twenty students out of about 400 to 450 inquiries. We take those students whom we think will benefit most from and contribute most to SEAL.

COMMENT: The reason I asked the question about the job experiences on a volunteer basis is that I think that if a student is willing to volunteer as an apprentice, the experience gained is invaluable and also this volunteer work often leads to a paying job.

A. I'd like to answer the question about placement as far as SMVTI is concerned with student job placement. A recent study shows that our worst year of placement was 62 percent and the best was 100 percent. The types of jobs fluctuate with the demand and the interests.

Q. How many students at SMVTI are out-of-state?

A. We serve Maine primarily and at present can take twenty out-of-staters, but it varies.

COMMENT: Dr. David Dean, University of Maine/Ira C. Darling Center. We have had a program at our Marine Laboratory for the past four years called the Learning Service Volunteer Program. This is primarily for high school students who come to the lab to work with one of the scientists on some project. In a couple of instances we have hired the volunteers the following summer because of the qualities they have shown. We have found the program to be quite beneficial to the students. Other institutions or organizations should have similar programs.

COMMENT: Dr. Warren Little, New England Aquarium. There are close to sixty volunteers at the Aquarium at the present time, about thirty of whom are in the Education Department. Many times when positions open in the Education Department we fill them with our volunteers. We are glad to talk to anybody from New England about volunteer work.

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DR. WARREN LITTLE

I now would like to introduce our luncheon speaker. I think it is fair to say that Maine is extremely fortunate to have such an active and driving force in the area of marine resources. I know that he has a lot of things going and a lot to do, so I will let him get started. Mr. Spencer Apollonio, Commissioner of Marine Resources for the State of Maine.

Thank you. I have been asked to talk about the problems of developing marine resources. I do not have much of a perspective to talk about except as we see them from the State of Maine. First I will talk about the general range of problems and then talk more specifically about some marketing problems, because this is an area which is perhaps overlooked many times. If the resource exists and there is a market for it, how do you overcome the intermediate problems of getting resources to market? This is a very critical aspect of any kind of development of marine resources. With that overview in mind, I'll begin.

On the national and international levels, the fisheries is a very strong, healthy and rapidly expanding business. Fisheries is certainly one of the most rewarding, most promising, most active of the general areas of economic activity throughout the world. In fact, some economists have stated that it is expanding world-wide now as rapidly as it should expand. That is to say that any greater rate of expansion of activity, investment or development would, in fact, create problems that would be unmanageable--problems in excess of the problems that any normal healthy business encounters.

It is a fact that almost any conceivable fisheries product has a market someplace in the world. The problems that we face in realizing these potentials, however, can occur at almost any level of development from the sea all the way through the intermediate activities to the consumer. It's not possible really to single out an area and say, this is the problem of fisheries; it's not the way it works. It's much too complex a business. There may be a problem, for example, in finding a locally abundant concentration of fisheries or marine resources. This is the obvious kind of problem. In the case of commercial fishermen, this may affect them directly. They don't have the time, generally speaking, to carry on the exploratory work necessary to find a stock that they can harvest. This is a limitation that all fishermen face.

In Maine our Department of Marine Resources is currently carrying on the exploratory fishing work to find commercially abundant populations of offshore quahogs and scallops along the coast. We know they are there, the fishermen know they are there, but the fishermen can't take sufficient

time from their own daily work or earning their living to go find and identify the locations.

This is a problem that is common to many fisheries, and it is generally a function of a government agency such as our own, either at the state level or at the federal level, or even in some cases the Food and Agricultural Organization of the United Nations. It is an activity that is carried out on the international level also.

But even in the presence of abundant and identified commercially valuable resources it is of no help if they can't be harvested for whatever that reason may be. I can give you two examples of these harvesting limitations here in Maine. For example, Maine is in a very strong competitive position in the soft-shell clam market, which is presently worth about \$5 million per year, perhaps more, to the diggers in Maine. But Maine has tens of thousands of acres of soft-shell clam growing areas which are closed and cannot be harvested because of pollution making them unsafe for human consumption. Further, many thousands of sub-tidal clams cannot be harvested simply because there are laws on the books which prohibit the use of certain kinds of harvesting equipment which could be used and would permit the harvesting of sub-tidal clam populations. Another example is the fact that last summer from out of the port of Portland, many Maine fishermen were not successful in catching the available bluefin tuna populations in the Gulf of Maine (to fill an existing and strong market demand which was offered them at a record price) simply because the available gear was inadequate for the fishery and further, the state law forbids the use of certain kinds of more effective harvesting gear.

So, here are examples of available resources and abundance identified as far as location is concerned with buyers ready to buy; yet because of either pollution, legal or technical reasons, the fishermen were restrained from harvesting those resources and taking advantage of those markets.

The availability at the same time in the same place of two or more resources may create serious problems of gear conflict. As an example, the availability of scallops on the Maine coast harvested with chain drags on good lobster bottoms is the cause of long-standing problems of gear conflict. Similar conflicts are also found, particularly during the winter season, between shrimp fishermen and lobstermen in certain areas or between shrimp

fishermen using one kind of gear and shrimp fishermen using another kind of gear. The same kind of problem, limiting the potential development of a resource, can also be found between our herring seiners and our lobster fishermen in other areas.

Generally speaking, these conflicts in the past have been kept apart by an attempt to restrict the efficiency of one of the parties to the conflict. The closed season, for example, prohibiting the taking of scallops in summertime during the principal lobstering season may in fact have the effect of harvesting scallops in a less than optimum season when the meat quality may be reduced as far as the consumer is concerned.

The economic problem associated with the availability of gear, of course, is that of acquiring the necessary investment capital. This is a particularly serious problem in New England at this time. Maine does not now have an offshore herring or sardine fleet and so cannot harvest the offshore stocks which do exist. Further, there is no way of acquiring the capital necessary for the million dollar harvesting vessels that would be required to develop this fishery. These problems always slice in two directions. On the other hand, many fishermen are apprehensive about the prospects of low interest, easy loans bringing too much harvesting or fishing equipment into a fishery thus creating excess competition for the fishermen who are already there or who have rated their business on the basis of available equipment.

Two of these problems, the availability of practical gear or the funds to acquire such gear coincide with the untapped potential of offshore squid resources in the Gulf of Maine. All of these problems seem to focus in on this particular example. Squid is a product which is in high demand throughout the world. There is an abundance of squid off the New England coast, but the availability of gear or the availability of investment capital to provide the gear is a serious limiting factor as far as New England fishermen are concerned for harvesting that resource. In the meantime, the resource is being harvested by at least three or four nations already aware of the potential. Assuming that we can harvest the product, there remain problems of holding, processing and delivering fishery products to the markets. All of these problems face us now as our Department of Marine Resources attempts to develop so-called underutilized species--those that are not at their obvious optimum market potential.

A number of underutilized species are found in abundance in Maine. Strong market demands do exist for them in various European, Asiatic and even domestic markets. If live Maine shrimp, for example, could be delivered to Japan through Bangor International Airport through Boston, they would be worth at least \$1 each. On a per pound basis that comes out to about \$30 per pound, roughly speaking. The holding problem, then, for large shrimp and other similarly delicate but high-priced species is a technical problem which undoubtedly will repay the technical research that will be necessary to solve the problem, which in turn will permit the development of many similar market possibilities.

Another area of technical concern is that of aquaculture--the general area of aquaculture. The practice that has been widespread and economically important throughout the world, is still in its infancy here in Maine. Small training programs to prepare people for jobs in aquaculture are now being carried on in Maine at a very low level. However, the fact that they exist is hopeful, and we certainly hope that this will be an expanding field, not only for the commercial development but that the educational possibilities will expand to coincide with the demand which will undoubtedly develop. It is a field which will eventually require considerable degrees of skill and knowledge in many fields of biology, engineering, water quality control and marketing. Aquaculture, in fact, is really just a special case of the general rule: In fisheries today, whether under management and control or wild on the high seas, there is a demand for training, investment, competition and knowledge of law, quality control, processing and marketing--all at a high and complex level as far as professional and technical training is concerned. It is slowly being recognized that specialized education must be forthcoming to meet these challenges.

While the knowledge of the biology and ecology of the marine resources is essential, and while the latest information on harvesting methods and availability of harvesting and processing technology is vital to the efficient operation of the commercial fishing industry, unless the market exists or has been identified and developed so that the seafood product can, in fact, be delivered to the consumer, all of the knowledge may only be of academic interest. Obviously, the name of the game for fishermen and

processors is profit. Thus, though there may be certain species existing in large quantities in the Gulf of Maine, it may be of no significance to the business community because this species has no value or insufficient value in the marketing place.

In a general way, the marketing of fisheries products involves many of the same problems found in marketing of any other food product. Competition is always a major factor, as is the so-called law of supply and demand. The eating habits of the potential consumer, however, have a direct bearing on whether a specific food product will receive ready acceptance. In a more subtle way, the name of the product may affect the way the consumer reacts to the product. Thus, horsemeat traditionally lacks the appeal of beef, and a product marked "snakesteak" might wait a long time for a customer. So, in fisheries it is difficult to understand why an excellent food fish such as pollack should be difficult to sell under its own name, but it is. It is difficult to sell pollack as pollack. But change the name to Boston Bluefish, and there will be substantial sales. The National Marine Fisheries Service has had extensive experience with this fact. Viewed objectively, it is just as puzzling to find that catfish is in great demand, especially in the Southern states. The dogfish, a product equally flavorful and nutritious, has practically no market at all in the United States, even though it's been long popular in Europe. Catfish is in; dogfish is out. Actually, the marketing of seafoods involves many paradoxes such as this. The most notable is the current situation in the fisheries where increasing shortages of many traditional species have developed for which there has been a steadily increasing market demand. At the same time the industry finds very limited market demands (especially domestic market demands) for less well-known items that may be relatively abundant.

Maine presently has over forty varieties of fish and shellfish available in the inshore and offshore waters, and that's probably a conservative figure. Markets exist, as we have noted, for practically all of these somewhere in the world. In the United States the traditional fin fish, such as cod, haddock, halibut, swordfish and herring have enjoyed popularity. So also have shrimp, lobsters, clams, scallops and oysters, but there has been far less domestic interest in readily available creatures, such as

mussels, sea urchins, periwinkles, alewives, hake, mackerel, dogfish, skate, crabs, conch, eels and elvers. With the decline in availability of the traditionally popular species, the commercial fishing industry has been attempting to diversify its products. Specific efforts have been made and are being made to develop or locate or make feasible the viable markets for the so-called underutilized species. It is interesting to point out that even though these species are underutilized here in Maine, one of the reasons that there is a strong demand for them, and there is a market potential for them, is that they are not underutilized in other parts of the world. They are fully utilized and, in some cases, overutilized. These efforts involve consumer education in potential markets, which is an expensive process unfortunately, and also involve identifying the foreign markets and any problems associated with them.

As I mentioned earlier, there is no doubt that all of these species can be sold someplace under some circumstances. Getting the buyer and the seller together is a very complex problem. The key elements are to reassure the customer that you have an availability of raw materials and that the development of the product form is acceptable in a specific market area. It is not sufficient to tell the customer that you have an availability of raw materials and that the development of the appropriate product form is acceptable in a specific market area. It is not sufficient to tell the customer that you have shrimp. He wants to know what kind of shrimp, how you plan to pack it and how you plan to present it to his consumer. You must assure adequate quality control in the harvesting, handling, processing and delivering, and the identification of a satisfactory and economically feasible means of transportation to the markets. Most important of all is the establishment of a sufficiently high price for the product to insure a profit to the producer. If any of these elements is lacking, there is not much chance of success. That's why I started out by saying it is difficult to identify a particular area as the problem area for the development of the process. These areas may apply individually at different levels depending on which species you are talking about. Even though mussels (which the University of Maine, Department of Marine Resources and University of New Hampshire are all interested in at this point) have been popular as food in Europe. Even though they are abundant in Maine, even

though they are in an acceptable form, even though they are of excellent quality and a satisfactory means of transporting the mussels is available, the Maine industry will not and cannot serve the European mussel market if the price for mussels is not high enough to justify the activity.

Sometimes we get a bit overenthusiastic in Maine because we do have this resource, we know it is used, and we know that the quality is good. We tend to forget the fact that fishermen have got to get a price on the other end that will justify their efforts. This is an area we are still not sure about, whether in fact, in the case of mussels, that this can be done for an overseas market.

Obviously, it is impossible here to do more than indicate some of the factors and complexities that are involved in the marketing of seafoods. This outline, however, does suggest one final paradox that exists within Maine's commercial fishing industry and indeed in most of New England's. That is it is clear that the need for expert marketing assistance within the industry is, or ought to be, in great demand. And yet because Maine's industry consists of many relatively small companies which must operate with limited capital, few of these companies are in a position to afford the sophisticated marketing services that they in fact need if they are to survive and prosper. In all honesty then, we have to report that the future for jobs in the marketing field is rather uncertain. Perhaps one thing is certain in this very uncertain business, and that is that conditions are changing constantly. These conditions are affected by such things as the Common Market, exchange rates, balance of payment, even public health problems such as the problem that we had with swordfish two or three years ago. All of these things can develop rather rapidly, change very quickly and have a very substantial impact on the marketing prospects for various kinds of species and, in turn, will affect the interest of the fishermen for developing them.

One development which might change the entire picture rather rapidly would be the passage of legislation by Congress establishing United States interim jurisdiction over its fisheries resources up to 200 miles from the coast. Such a move would obviously give our domestic industry a tremendous advantage over the huge foreign fleets which are harvesting millions of

pounds of fish of all kinds from the waters of the Gulf of Maine and Georges Bank. The resulting growth of all segments of the domestic industry will undoubtedly be substantial. With this growth would come far greater opportunities for those who may be interested in the area of seafood marketing as well as the other areas that go along with it.

So, to sum it up, it bears repeating that on the national and international levels, the fisheries is a strong, economically healthy and rapidly expanding business. There is a market someplace in the world for almost anything you can harvest from the sea. The diverse problems relating to the fisheries are inter-related; it is difficult to separate one out and isolate it from another and say, "This is the key problem." If you develop a technological breakthrough, then your marketing problems may be solved or your transportation problems may be solved, or the technological development may attract the capital that you previously lacked for the development of harvesting equipment. So clearly, fishermen, processors, marketers, marine scientists, lawyers, economists, sociologists, and government people last of all, must work together. There is a bright future in this area, but the future is inextricably tied up with many, many problems.

Q. Are there steps that a community can take to determine the feasibility of reopening a soft-shell clam flat area, perhaps for use with a depuration plant?

A. The best solution is to cure the pollution source. The community needs advice as to how to proceed because not all of the engineering solutions proposed in fact solve the problem. Several towns have spent a great deal of money and have not solved the problem. The depuration process and problem is a tricky one to answer as we are not sure how many depuration plants can exist economically on the coast of Maine. Under the present legal situation, which is very complex, there is always the question of availability of clams. Are there enough clams to assure the efficient operation of the plant?

Q. Are there any summer fisheries programs that exist similar to the National Youth Conservation Corps?

A. I am not aware of any. Perhaps someone in an educational field could provide an answer.

A. I'd like to respond to that. I'm with the Bureau of Vocational Education, and we are currently studying the feasibility of starting, in September, three pilot programs within the vocational system for the young people we know are going fishing. The program is designed so that by the time they graduate from high school, they will have the requisite skills to go fishing.

Q. What is the dollar value of Maine fisheries?

A. Landed value is approximately \$40 million a year, probably a little bit higher because we are pretty sure it is under reported. However, the value to the state is conservatively in the area of \$200 million a year which puts it up there close to pulp and paper. The value of the fisheries does not stop when the fisherman is paid for his catch.

Q. Is it increasing?

A. Yes. This year the lobster industry went over \$20 million landed value for the first time in history.

Q. Would it be possible for an outstanding high school student interested in biology to get involved in a summertime program at the Boothbay facilities?

A. Yes. We have one building that we have taken over at Boothbay Harbor which we intend to convert to dormitories for students. We will have a number of students for a short time this summer--about six weeks. We don't quite know how we will finance it or what exactly they will be doing, but it's our intention to make that space available for students who want to come, whether it is in the wintertime on an intermediate semester program or during the summer.

Q. Will there be some kind of notice to high school counselors regarding this?

A. I suspect so, yes.

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PAUL D. RING

Today I take great pride in bringing three marine professionals to you. Two of these gentlemen are here and the other is on tape. Frank Luke is president of the Maine Boatbuilders and Repairers Association and also vice president of Paul Luke, Inc., in East Boothbay, a business that his father established. It's been there many years and produces a lot of boating hardware to go along with the boats. Frank will talk to us about the profession of boatbuilding and running a boatyard.

Cy Hamlin is a naval architect. He has a company of his own called Ocean Research Corporation located in Kennebunk. He will talk to us about what a naval architect is and does and what the training requirements are in order to be a naval architect.

Now I would like to introduce Frank Luke.

FRANK LUKE

Thank you. I will begin by commenting on the future prospects of boatbuilding. I am not talking about shipyards like the Bath Iron Works but about small three-, four-, and five-man outfits up to those employing twenty-five or thirty men. The future of these yards in Maine looks good. That is all there is to say. Boating, boat building and construction is going sky-high. We had problems in the energy crisis when certain raw materials in the fiberglass industry were hard to come by, but that's all they were--hard to come by. I don't know of anyone who was laid off because of an inability to get materials. There was always someone pushing hard on the suppliers to get the material to us, and we got it, so no one was laid off.

In Maine we have quite a good diversification of hull construction methods and materials. We have a number of yards working with fiberglass constructing all types of boats--work boats to luxurious racing sailboats or cruising boats. These yards are doing very good work. There are also yards working with metal, steel and aluminum.

Storage is perhaps the area of least investment, best opportunity and most headaches that we can look to in Maine. There is no problem as

far as filling up the storage spaces with boats--people come from as far away as Long Island Sound and even further south just to have their boats stored in Maine. However, the storage business is hard work, and it only takes one or two people who fail to pay their bills, and storage doesn't pay at all.

Usually a person will start out in a boatyard capitalizing on his excellent skill as a mechanic, shipfitter, or some other special skill that brings the clientele into his yard. He will do such a good job that his business expands--someone wants him to build a boat--and he is required to hire help. Suddenly he is no longer doing the work he was most able to do. He is in a supervisory capacity. He has no training in this area and no real desire to be there. Quite often this is the point when his boatyard fails. Why? Because he has not received any education in basic business techniques. I received a degree in accounting at college but this was gross overkill. What I and others in the boating industry and other small businesses need is knowledge of small business techniques. How and when is it necessary to fill out a W2 form? What services do banks provide? What are the services of the Small Business Administration? When do you go to private sectors for financial backing? The whole realm of finance is left out of many educational fields, and it is needed.

As far as skills which are needed in the boatyard are concerned, the skills of a boatyard mechanic are in great demand. The mechanic is the guy who can get down in the bilge of a boat, lie on his ear, put his feet in the air and take pride in fixing an old rusty engine. He's a hard man to come by, but he gets paid well, and he's got work every day for as long as he wants it. The type of person is even more important in this case; it's the attitude that's necessary. Pride in his work is essential.

The same applies to a boatyard machinist. The job of boatyard carpenter is probably one of the most difficult in the entire yard--the shape of the hull is round but must be plumb, the material must be strong, uniform and capable of stress but not too heavy for flotation--or racing potential, if that's what's wanted. Then we come to the painter. Now he must almost be a kind of chemist. Every process of boat construction has its own sequence of paints. Aluminum boats have one sequence of paints, but don't use them on a steel boat. Wood boats require another--and fiberglass boats still

another. If you are operating a storage yard, you have to be prepared to paint all kinds. To operate a successful boatyard of any kind, you have to care about what you produce.

PAUL RING

Thank you Frank. Before I turn the floor over to Cy Hamlin, I just want to mention that Cy researched and designed the Clearwater sloop and is also presently involved with a project called the Maine Coast Transportation System.

CYRUS HAMLIN

There are probably not more than two or three thousand practicing naval architects in the United States. It's not a very big field, but you may have come across a student who has said he wanted to be a naval architect. He was probably pretty persistent. This is the way they get started.

A naval architect, by the way, is also a marine engineer, a marine architect or a yacht designer. The word "naval" doesn't refer necessarily to the navy itself. What a naval architect does is to design the complete vessel system. It could be a 14-foot rowboat or it could be a 1400-foot tanker. But he designs the complete system--the hull form, sewage system, water system, the powering, heating, living quarters, etc. It is interesting to note how versatile the naval architect has to be. A house architect pipes the heat in from somewhere and pipes the electricity in from somewhere else; the house just stands on the foundation. A naval architect has to design a structure which will withstand extreme forces from the sea--the heating effect of the sun and the cooling effect of the water. Vessels have been known to break in half from that tension. The naval architect has to put into this structure a power plant that will move it; he must design a structure that will move efficiently. All the services and accommodations for people must be incorporated in the vessel. In order to do this a naval architect must be extremely versatile. He must have training in many fields and, as a matter of fact, I venture to say that half or two-thirds of the trained naval architects are in other fields

because of their necessarily broad training. Some of these have jobs with a marine bias, some are totally divorced from the marine field just because they learned an overview type of approach to things as well as specific specialties in these skills.

There are two levels of naval architecture, and perhaps these should be stressed because they are important in the guidance process. There is the small craft designer (small craft are defined as vessels up to about 50 feet), and there is the large vessel designer. The difference is that the small craft architect generally is in charge of the office and oversees directly all the operations while a large vessel designer is probably part of a team of two, three or five hundred people, working on a single design. Obviously, if a person is in the top echelon, he would be quite divorced from many of the subsystems of the vessel. Most of the people who come to you yearning to be naval architects will probably be happier in the small-craft level of designing. It's much more satisfying and if they are lucky enough to have one qualification, a sizable independent income, they can probably make a go of it.

I started out as many yacht designers have by working in a boatyard and doing some work in naval architects' offices which served as kind of an informal apprenticeship. My start in boatyards was by accident of geography as much as anything else, but I've always been glad that was my fate, because a naval architect is essentially a sculptor of materials, materials of all kinds. He has to know what these materials will do, how much he can strain them beyond their supposed limits. The only place he can get this kind of experience is in a boatyard. This is recognized in most courses now so that the student can go to shipyards and get this practical experience.

Now, how do you become a naval architect? As I've said, I did it through the boatyard, and I have taken some professional courses. I would really be happier and better off if I had been able to take some basic courses early in my career, but at that time we had to take the four years or none at all. Now I believe you can be more choosy about taking courses.

There are several schools of naval architecture, but I will only mention three. The Massachusetts Institute of Technology has a course which is called ocean engineering which exemplifies the spread of naval architecture into all types of other things--submarines, offshore rigs, Texas towers.

There is no clear line of demarcation; ocean engineering is naval architecture and vice versa. Webb Institute in Glen Cove, New York is a school devoted solely to naval architecture. It is very heavily endowed and very competitive to get into; however, if you can get your students into it, I would say it was well worth doing. The last of the three is the University of Michigan which has an excellent school of naval architecture.

There are also two correspondence schools of yacht design. One is called the Westlawn School of Architecture which is operated by the National Association of Boat and Engine Manufacturers. There is also a school here in Maine started recently by Ted Brewer in Brooklin, which is probably good. I am not familiar with the material but he is a competent designer. However, I am not that much in favor of correspondence schools; their attrition rate must be about 90%. But it is one way to get started and then go take a few summer courses at MIT or something of that sort.

Naval architecture is also being offered at other colleges--the University of New Hampshire and Maine Maritime, for example--but these are minor courses; however, they are possibilities.

I've checked with both Bath Iron Works and the Portsmouth Navy Yard about job opportunities, and neither offers very much for the naval architect. Portsmouth Navy Yard has nothing, and the Bath Iron Works is looking for a couple of specialized types of naval architects, paying \$12,000 to \$14,000. Boatyards generally don't have their own naval architects as they are an expensive luxury. I would guess that a boatyard would have to have at least 50 to 75 employees before it could afford its own naval architect. So, generally, naval architects operate in their own private offices, doing the best they can.

Naval architecture is a very complex science. Some of the mathematics of the study of water flow have pages and pages of formula; however, for practical naval architecture any good high school or college level mathematics education is ample. You need imagination; you need to be able to picture things in your head. You must have common sense because you are dealing with a very serious thing. You are dealing with people's lives. The vessel must stay afloat.

Q. Is there any ferroconcrete construction here in Maine?

A. Earle Rummery down in Biddeford has finished a couple of ferrocement boats; however, I don't think the hulls were constructed here in Maine. Ferroconcrete is interesting material, and I think at this point will probably take its place in backyard construction. It's a material that most anybody can work with; it's not expensive to make the hull. Actually, it's not expensive to make any hull; it's the finishing that takes the time and money.

Q. Mr. Hamlin, what is the Maine Coast Transportation System?

A. When I first moved to Maine in 1939, they still had one steamboat carrying passengers. Now it's gone, but technology has improved, and it occurred to me that there is a possibility of the return of marine transportation along the coast. In the last ten to fifteen years we have seen the development of the Maine Ferry System formerly run by lobster boats before the addition of two steel vessels, and we have two ferries running to Nova Scotia. A cruise boat has come along the coast a couple of times. But I would like to see the Maine Coast Transportation System provide one-day service between Portland and Eastport with about six stops along the way. Unfortunately, we haven't been able to generate the funding for a formal feasibility study.

Q. Is there a market for boatbuilders, for apprentices?

A. Certainly there is. There is a boatbuilding course down at Lubec--Washington County Vocational Technical Institute--started and taught by Ernest W. Brierley. He has had applicants from all over the world.

Q. What's the job market for students from WCVTI?

A. They have no trouble getting jobs in boatyards as they have been introduced to all the activities of the boating industry.

Q. What is the opportunity for apprentices who have not had any previous training to get a job in a boatyard?

A. Not always that good. There is much more opportunity if he has had some previous training.

Q. What kind of a program does Lance Lee have at the Bath Marine Museum?

A. It's an apprentice boatbuilding program with the major emphasis on acquiring the skills needed to build the small, traditional type boats.

PAUL RING

I would like to show you now a video tape of Hal Arndt telling you about his marine-oriented corporation--Marcrafts, Inc. We made the tape last week, and I am afraid you'll have a little trouble asking him any questions!

HAROLD ARNDT

Marcrafts, Inc. is a relatively new corporation specializing in the design, testing and manufacture of modern fishing gear. The corporate efforts are divided into two basic fields. First is the modernization of conventional fishing gear design by utilizing modern construction materials such as aluminized belted steel wire mesh, vinyl coated steel wire mesh, synthetic fiber, thermal plastics and extruded plastic netting. Second, by using the same materials we are designing new kinds of gear for capturing formerly underutilized species like eels or shrimp and aquaculturally raising limited species like oysters.

To give you an idea of the variety of our products, we can make at least 30 varieties of lobster traps with 25 variations, ranging from a small inshore trap to very large offshore traps. We make Chesapeake Bay crab traps, green crab traps, eel traps, perch traps and shrimp traps. Other products that we make for the traditional fishermen are buoys and several sizes of rope, or pot warp, and a series of twine for net mending or lobster trap heads. These products are made from nylon, dacron and polypropylene on high-speed braiding machines.

Our need for people and their talents is as varied as our products and corporation objectives. Marcrafts is unique and cannot draw from a pre-trained group of potential employees such as plumbers or electricians. We must train all of our employees. Wire cutting requires a long training in

wire-use efficiency and constant attention to what one is doing. Trap assembling itself looks simple but, in fact, requires a considerable amount of training in assembling techniques which each builder must master completely and perfectly.

The winder machine operators who wind the thread for the braiders must possess good judgment and patience. Braiding machine operation is a very delicate, highly sensitive job requiring great skill and patience.

What does Marcrafts look for in its employees? Most important is motivation. We look for people with the desire to really work and perform a good job in exchange for personal satisfaction and wages. When we see motivation in an individual, it is usually combined with the ability to think on one's own, the willingness to think and the desire to do a good job and even to enjoy the job. We believe that a self-motivated individual is a successful individual and a real asset to any company.

DR. WARREN LITTLE

I think it is always difficult to be at the end of the program, but there is a reason for putting Dr. Dean and Dr. Savage at the end of today's program. Earlier today Thayer mentioned that we've long had the impression that a doctorate in oceanography is necessary in order to get a job in oceanography. We now know this is not true, but let's hear now about what kinds of opportunities do exist for the student with a master's or doctor's degree. Our next speaker is Dr. David Dean who is the Director of the Ira C. Darling Center at the University of Maine and the head of the Sea Grant Program. He is also professor in marine biology.

DR. DAVID DEAN

It is a pleasure to be here. I would like to inform you on two points and only two points. The first is what kinds of jobs are available at the master's or Ph.D. level, and second is how you should advise your high school students to train for these types of positions.

The traditional type of job for people with master's and Ph.D.'s in the marine sciences has been with the universities, state research laboratories and federal research laboratories. These three groups probably

account for the hiring of 90 to 95 percent of the people with advanced degrees. However, within the last very few years there has been quite a switch in the job market.

Environmental awareness has created a whole group of environmental survey-type companies. One which is close at hand is Normandeau Associates in Manchester, New Hampshire. They employ approximately sixty people at various levels of training. This company has just received a contract to do the study of environmental impact of the Gibbs Oil Refinery Port in Portland. There are a number of such companies all over the United States; sometimes larger companies such as Westinghouse and Raytheon, have their own environmental departments. I think the EPA alone is going to hire something like a hundred people with masters' degrees in the environmental sciences. With the need to provide environmental impact statements, you have to have people on both ends--people who can go out and prepare the statements of what will happen if such and such is constructed or modified and the people who interpret and judge these impact statements.

How does one prepare for a career at the master's or doctor's level in marine biology, marine geology, fisheries, aquaculture, biological oceanography, chemical and physical oceanography and so on? First, let me say how NOT to recommend someone to prepare. Don't recommend that they go on to the baccalaureate level and specialize in marine biology, marine geology or whatever. Recommend that they go to any good liberal arts school and become first and foremost a good biologist, a good geologist or a good physicist. After they have gotten breadth and depth in their specialty, it is time to apply this knowledge at the graduate level working on some sort of marine problem. Do not let them specialize at the undergraduate level; I can't emphasize that too much.

Where do you go for specialization later? You have all received a copy of University Curricula in the Marine Sciences and Related Fields. This lists almost every school in the country and their curricula in the various marine sciences.

DR. WARREN LITTLE

Our next speaker is Dr. Jeffrey Savage from the University of New Hampshire where he is an ocean engineer, head of the Mechanical Engineering

Department and Director of their Sea Grant Program. I also understand he's actively involved in the design and research of submersibles.

DR. JEFFREY SAVAGE

Ocean engineering is engineering in the ocean, and I would like to talk about what engineering is because it certainly means different things to different people. Webster's Dictionary defines engineering as 'maneuvering' or 'contriving to build something such as a structure'. Some of that definition probably comes from recognizing that the first engineers were primarily concerned with moving heavy things around. In civil engineering those heavy things were actually cannons, and it was for making war. Civil engineering was the first recognized professional engineering; after that probably came mechanical engineering--Watt and his steam engine--and then came electrical engineering, chemical engineering, etc.

Ocean engineering is nothing but engineering in the ocean, and as David Dean said of oceanographers, we believe that a man should first be a very good engineer before he begins to engineer in the ocean. We therefore have very little sympathy with the idea of undergraduate ocean engineering although there are schools in the country that do offer such degrees. Also there are a lot of professions that are called engineering which to me are not engineering. Engineering to me is also to do something new--that which has not been done before, such as building a railroad under San Francisco Bay or designing something like the Alvin which goes deeper in the ocean than anybody has gone before.

We have had a program at the University of New Hampshire oriented toward engineering in the oceans since 1965. Some of our graduates have done some very exciting things. One of them is vice-president of a company called Arctic Engineering Inc. He built the first air effects drilling rig which is now operating in the Arctic. He is 29 years old--used to be an electrical engineer and is a very successful engineering leader. We have a fellow who is the No. 2 technical diver in the Navy who has qualified at 650 feet and has done most of the Navy's Arctic diving to plan some of the things they are concerned with about defenses in the Arctic. Some are working at Raytheon, Normandeau Associates and other places, but about half did not end up in the ocean at all because they found they didn't like it.

So, part of our program is to help young people go someplace and to find out where they want to go. I think it is very important for the undergraduate to try and get some experience on jobs in the summertime so that he will know what he likes. Also, it is important to be a good engineer. If you are a 2.1 student, your chances of getting any place in the field are about zero. Second, if you are going to be an ocean engineer, you probably should have a master's degree or the equivalent thereof.

As I have said engineering is maneuvering and contriving. We have a master's program in ocean engineering, but we don't give our students much in the way of courses. They are primarily given the opportunity to build something, to conceive and build something and see if they can make it work. If you don't like to conceive things and make them work, then you won't like being an engineer. Some of our students built a vibratory coring device which can take cores at 28 feet, about as good as a lot of engineers in industry can do. Some others built a recompression chamber which happens to be the only portable one on the East Coast and has been used by a lot of groups up and down the coast. It weighs about 20 tons, and they have even maneuvered it to Lake Winnepesaukee. Some others came up with a discus buoy in a system that doesn't move more than 15 degrees.

We can only handle about twenty to twenty-five undergraduates and about twenty-five master's and five or six Ph.D. candidates at our Mechanical Engineering School; however, we are no more limited than any other school. Some other schools that have good programs in ocean engineering are M.I.T., the Universities of Miami, Rhode Island, Washington, Hawaii, Texas A & M and Oregon State.

I do not want to sound discouraging but ocean engineering is a tough field to get into, but it is a very rewarding field. However, we want bright, alert people who are not afraid to work hard.

Q. How much does it cost to attend either one of your graduate schools?

A. Savage. Well, if the student is a good student, it doesn't cost him anything. As a matter of fact, I'd say that three-quarters of the students in the hard physical sciences in engineering who get their degrees beyond a master's degree are getting them on research assistantships or teaching assistantships or something else.

A. Dean. The same is true at our marine laboratory and in the Department of Oceanography. All of our graduate students have graduate assistantships, research assistantships. We have no scholarship funds or anything like that specifically, although there are some general scholarship funds, but they don't pay the full tuition. Graduate students on research assistantships pay tuition at the in-state rate, and we pay the graduate student \$3,799 and \$3,900. We are hoping to upgrade this as soon as possible to \$4,700 and \$5,000 a year. This is for half-time work on a research program.

Q. What is the difference between environmental engineering and ocean engineering?

A. There is little difference if you are talking about salt water. While the environmental engineer may concern himself primarily with sanitation engineering, sewage outfalls, he is still an ocean engineer.

DR. WARREN LITTLE

I would like to thank all of our speakers. I know that I have learned a tremendous amount from this day's experience. I've enjoyed having the opportunity to meet so many of you, and I think you all for coming.

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MAINE SEA GRANT PUBLICATIONS

Information Leaflets

MSG-IL-1-73	Ring, Paul D. <u>Marine Research and Development Being Conducted at the University of Maine.</u>	Free
MSG-IL-2-73	Ring, Paul D. (ed.) <u>Marine Related Films Available from the University of Maine Film Rental Library.</u>	Free
MSG-IL-3-74	Reynolds, Clark G. <u>Nautical Historians Consider Organizing.</u>	Free
MSG-IL-4-74	Ring, Paul D. <u>Problems in Marine Science I. Ocean Currents: Water Movements in the Atlantic Ocean.</u>	Free
MSG-IL-5-74	Richmond, Mark S. <u>Oyster Culture in Maine-- Specifications and Approximate Costs of Rearing Equipment.</u>	Free
MSG-IL-6-74	Bender, Norman K. <u>The Capital Construction Fund.</u>	Free
MSG-IL-7-74	Reynolds, Clark G. <u>Law of the Sea/Nautical History.</u>	Free
MSG-IL-8-74	Smith, Frederick J. <u>Fishing Business Management.</u>	Free
MSG-IL-9-75	McAlicie, B. J. <u>Preliminary Check List of Planktonic Microalgae from the Gulf of Maine.</u>	Free
MSG-IL-10-75	Roberts, Kenneth J. <u>Understanding the Emergency Energy Shortage Loan Program.</u>	Free
MSG-IL-11-75	Ehrbar, Charleen. <u>The New Maine Oyster Industry.</u>	Free

Bulletins

MSG-B-1-73	Ring, Paul D. (ed.) <u>Maine's Fresh and Salt Water Pleasure Boat Service Industry Boating Business Workshop, March 26, 1973.</u>	\$1.00
MSG-B-2-74	Hidu, Herbert and Mark S. Richmond. <u>Commercial Oyster Aquaculture in Maine.</u>	\$2.00
MSG-B-3-74	Ring, Paul D. and Barbra McCandless (eds.). <u>Maine's Fresh and Salt Water Pleasure Boat Service Industry Boating Business Workshop II, October 29, 1973.</u>	\$2.00

MSG-4-74	Lutz, Richard A. <u>Raft Cultivation of Mussels in Maine Waters--Its Practicability, Feasibility and Possible Advantages.</u>	\$1.00
MSG-B-5-74	Hamlin, Cyrus and John R. Ordway. <u>The Commercial Fisheries of Maine.</u>	\$3.50
MSG-B-6-75	Reynolds, Clark G. and William J. McAndrew. <u>The 1973 Seminar in Maritime and Regional Studies.</u>	\$4.00
MSG-B-7-75	Darling, Dana R. and Gregory C. Griffin. <u>Maine's Marine Industries--Vocational Education Planning Guide.</u>	\$2.00
MSG-B-8-75	Coggins, Phyllis (ed. and illus.) <u>The Uncommon Cookbook.</u>	\$1.50

Technical Reports

MSG-TR-1-72	Riley, John G., Richard J. Rowe, and Herbert Hidu. <u>Oysters: Reattachment as Method of Rearing Cultchless Hatchery Oysters.</u> Comm. Fish. Rev. 34(5-6): 41-43.	\$.50
MSG-TR-2-72	Riley, John G. <u>A Mechanized System for Oyster Production.</u> Amer. Soc. of Agr. Eng. Paper NA 72-106.	\$.50
MSG-TR-3-72	Riley, John G. <u>Mechanical Handling Techniques for Shellfish Production.</u> Amer. Soc. of Agr. Eng. Paper 72-574.	\$.50
MSG-TR-4-73	Blamberg, Donald L. and David C. O'Meara. <u>Dehydrated Scallop Viscera, A Potential Component of Poultry Rations.</u> Poultry Sci. 52(3): 1203-1205.	Free
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MSG-TR-6-74	Dunham, Wallace C. and Munden M. Bray. <u>An Evaluation of the Potential for Maine Raised Oysters.</u> University of Maine Life Sci. and Agr. Expt. Sta. Bulletin 709.	Free
MSG-TR-7-76	Slabyj, Bohdan and Carolyn Hinkle. <u>Handling and Storage of Blue Mussels in Shell.</u> University of Maine Life Sci. and Agr. Expt. Sta. Vol. 23, No. 4, January 1976.	Free

- MSG-TR-8-76 Hess, C. T., C. W. Smith and A. H. Price, II. Free
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Oysters and Sediments. Nature, 20 November 1975,
 Vol. 258, No. 5532: 225-226.
- MSG-TR-9-76 de Schweinitz, Elizabeth and Richard A. Lutz. Free
Larval Development of the Northern Horse Mussel,
Modiolus modiolus (L.), Including a Comparison
with the Larvae of Mytilus edulis. L. Bio. Bull.,
 June 1976.

Miscellaneous Publications

- MSG-M-5-73 University of Maine Coherent Project Sea Grant Free
Program Annual Report for the Year Ended April 30,
1973.
- MSG-M-6-74 A Proposal to Renew the University of Maine's Free
Coherent Project Sea Grant Program. Vol. I and II.
 September 1974.
- MSG-M-75 Magill, Robert N., Jr. A Short History of Free
Damariscove Island. August 1975.

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